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THE RELATIONSHIP BETWEEN FUTURE WILDERNESS AND *IN SITU* AND *EX SITU* PLANT CONSERVATION

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ABSTRACT

Extrapolation of current (1993) rates of wilderness destruction indicate that no significant areas are likely to remain by the year 2300. This likely trend is reinforced by the current continued growth of the human population.

The concepts of *in situ* and *ex situ* plant species conservation are examined in the context of wilderness loss and practical consequences are discussed including the concept of *ad valorem* species conservation.

INTRODUCTION

The Latin terms *in situ* (-in its original situation), and *ex situ* (-out of its original situation) have been used to describe different sorts of species conservation activity. *In situ* conservation refers to that which may occur in national parks or nature reserves comprising ecosystems which are considered largely undisturbed by human influence. *Ex situ* conservation refers to that which occurs when the habitat of the species is considered to have been disturbed so that the species can no longer persist without human intervention. In a managerial sense *in situ* conservation has tended to occur in national parks, while *ex situ* conservation has occurred in botanic gardens, arboreta and zoos.

The terminology has depended on the premise that undisturbed wilderness actually exists and that, as a corollary, the most desirable and economic form of conservation is that *in situ.* The inherent complexity of the simplest ecosystem, even presuming an adequate human understanding of them, has made their artificial maintenance very expensive or even impractical : (eg dipterocarp rainforest Ashton, 1989). Thus, *ex situ* conservation has not hitherto been seen as a long-term option of general utility, but as an interim often research oriented measure leading to an eventual return to an *in situ* strategy, for the species concerned.

Some field-based conservationists have been critical of the value of *ex situ* conservation measures, arguing that only *in situ* conservation can achieve lasting results. *In situ* conservation has many advantages and where possible is regarded as the ideal approach to conservation of community and biome levels of diversity. However, the majority of workers agree that the issue is not one of *in situ* versus *ex situ* conservation, and understand the two activities should be considered as occupying different ends of the same continuum of conservation management techniques.

Loss of wilderness :

Current rates of loss of wilderness are already changing the ways we need to look at conservation work in the future. The amount of vegetation in the world undisturbed by human interference is not known, but it is true to say that large amounts of so-called wilderness have been and still are being disturbed by humans. The arid land ecosystems of Australia provide excellent examples of wilderness areas, some managed as national parks, but all having experienced varying degrees of disturbance. *In situ* conservation of plant species in these habitats is clearly relative in meaning.

The increase in the proportion of depauperate wilderness in wilderness areas can be expected to grow, including inside national parks were available resources do not permit proper controls, as is found in Australia and numerous developing countries eg. Mexico, Malaysia. Yet even in 'depauperate wilderness' it may be more cost effective to maintain species *In situ* in relict stands over vegetation, than *ex situ* collections in a conservatory or garden remote from the locality. Taking this argument further, in areas where human population density makes it unjustifiable to set aside large tracts of land as wilderness, the possibility of *in situ* conservation of small enclaves of indigenous vegetation alongside sympathetic cropping systems, should be promoted. Dransfield (pers. comm.) has undertaken rattan species conservation studies in relation to the commercialisation of rattans in S. E. Asia, and they offer great promise.

Under circumstances where legitimate conservation management can take place in depauperate stands of vegetation or amongst field or forest crops, the meaning and legitimacy of use of the term *in situ*, is again relative in meaning.

Synthetic ecosystems :

In Europe and North America, where the science of ecology arose and where quantitative and qualitative ecological studies have been undertaken longest, there is now a body of data which enables certain simple vegetation stands to be reconstructed from their component species, using a "seed cocktail"; to be synthesised using ecological processes rather than by the crude intervention of spade or trowel. It is possible that this technology can lead to the synthesis of more sophisticated vegetation stands.

Examples of successful synthetic plant associations (*i.e.* associations of species capable of sustaining themselves in nature) include restoration of northern European *Calluna* moor (Putwain, 1987), regeneration of chalk upland grassland of the British Isles (Wells, 1987), synthetic prairie vegetation in North America and wetland habitats in the vicinity of Berlin (Rödel, 1987). There are other examples. While none of these experiments have included a component relating to conservation of rare or endangered species, it is conceivable that this could be factored into the system as the vegetation association stabilised. These experiments have largely been conducted by research ecologists rather than horticulturalists, but the importance of these ecological advances is significant for conservation managers.

Botanic and large private gardens have been used for the construction of synthetic vegetation associations for over one hundred years, with the creation of rhododendron woodland gardens, or alpine meadow gardens, bog gardens as well as the more overtly ornamental herbaceous borders and rose gardens. The important point is that a wealth of accumulated horticultural and botanical experience exists in the staff of these gardens, expertise which has not hitherto generally been directed into the purposeful creation of synthetic wilderness for conservation purposes: a garden has not traditionally been considered capable of becoming a wilderness. There are exceptions, however, such as the ecological displays in botanic gardens at Berlin-Dahlem, Marburg University and elsewhere, but the standards of horticulture and botany found in botanic gardens have too rarely been translated into the management of once-natural or natural ecosystems. This is precisely what is now increasingly occurring with endangered species recovery and reintroduction projects. The often excellent interpretative displays in zoos and botanic gardens are similarly less sophisticated or even absent in many national park wilderness areas and improvements are urgently needed.

Autecological research :

The conservation management of rare and endangered plant species depends not only on a clear understanding of the dynamics of the vegetation system of which the species is a part but also on the knowledge of the biology of the species itself. Only autecological studies can provide these data and , incidentally, the practical horticultural knowledge necessary to cultivate plants of the species. These same data often provide the key to why a species is rare or endangered, and enable management programs to be devised to encourage species recovery, (Taji & Williams, 1987).

The process of creation of synthetic plant associations similarly depends on a detailed understanding of the autecology as well as synecology of the component species and how they interact with each other at time of seedling establishment and, through competition, as successional elements in the ecosystem.

It is not surprising that our lack of detailed ecological information on many wild plant associations which we strive to manage, result in difficulties rather like those of a freezing person having firewood, but no means of lighting a fire!

Wilderness gardening :

If the present rates of wilderness destruction are extrapolated several hundreds of years hence and presuming that there will still be human interest in conserving what remains of the biota, it follows that viable wilderness plant associations will need to become more highly protected and managed. Only with increased management (and additional resources) will it be possible to retain and conserve diminishing wilderness which will become correspondingly and progressively more valuable to the community.

Weed control in wilderness plant associations will increasingly involve ecological and horticultural skills rather than broad-acre techniques. Species reintroduction projects to maintain species diversity in wilderness areas of reduced size will also involve combined ecological and horticultural skills. Manipulation of the genetic resources of particular species in the wilderness may become necessary to prevent inbreeding, or to maintain heterozygosity. Scientific and horticultural intervention is likely to increase in future wilderness areas for these and many other reasons, such as managing visitor pressure, providing for insurance against natural disaster with fewer seed reservoirs available for recolonising and re-establishment needs, providing habitat for particular animals, or ensuring that the life cycle of long-lived species is completed.

The cyclical maintenance requirement of wilderness plant associations of the future are likely to approach those of present-day commercial managed forest at the more extensive end of the spectrum, and an arboretum of large garden at the smaller. The "improved capital value" of wilderness will continue to become justifiable, over time, as having community importance in both heritage and commercial terms. Future wilderness which is not managed more intensively seems likely to either succumb to other community land use, or to deteriorate by genetic erosion, weed invasion or visitor pressure and cease to have meaning as wilderness, (Friis, 1989).

While it may seem speculative or unacceptable to contemplate that future wilderness should be managed like a series "gigantic wild gardens" it was equally unacceptable to many conservationists 30 years ago to countenance reintroduction to nature of rare and endangered species : this is now a cornerstone of thinking on maintenance of biodiversity.

Likewise, the possibility of creating self-sustaining synthetic plant associations did not exist in the 1950's, any more than we can now imagine the human population pressure which may exist on remaining wilderness areas in 2300 A.D.

A further dilemma which may face future managers of wilderness with even greater urgency than at present, is the choice of which ecosystems and species to practically conserve in the event of being unable to conserve all because of economic factors. The cost of conserving all currently endangered plant species is clearly unsustainable, as well as raising questions of philosophy and social acceptability. It seems likely that a system of evaluation of the community importance of endagered species could help debate these important issues which are almost certain to receive different receptions in developed and developing countries.

Against a predicted background of much diminished wilderness which will need to be more intensively managed to retain its scientific integrity, the use of the terms *in situ* and *ex situ* become increasingly redundant. It is suggested that a concept of *ad valorem* (according to value) conservation of species is a basis for further discussion to describe the approach to management of future 'wilderness forests and gardens' The ongoing acquisition of detailed ecological and taxonomic data on the least disturbed and least studied ecosystems is work which needs to be accelerated if conservation of biodiversity is to become a reality.

CONCLUSIONS

The continued growth of the human population is likely to at least continue the existing pressures on wilderness areas particularly in developing nations.

Resource constraints, in both developed and developing nations, are likely to at least continue to bring about the deterioration of the quality of wilderness plant associations.

The concept of *in situ* and *ex situ* conservation will become increasingly meaningless as wilderness plant associations diminish in quantity and quality.

The concept of *ad valorem* conservation of species may increasingly become necessary as it becomes physically and financially more difficult to conserve remaining wilderness and valued judgements become necessary on the cost efficiency of conservation options.

Ad valorem species conservation may enable chosen plant associations to be maintained synthetically in perpetuity as examples of "lost wilderness", as approximations to plant associations which have become extinct.

'Synthetic Wilderness' may become as important as 'ornamental gardens' for future tourism and recreation in a century from now.

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